

Automotive ICs / 車載用

Image Recognition Processors / 画像認識プロセッサ

| Part Number     |  | Maximum Operating Frequency (MHz)<br>MeP, MPE | Maximum Operating Frequency (MHz)<br>ARM Cortex-A9 MPCore | Media Processing Engine [MPE] | Image Processing Accelerator |         |        |           |                                       |                |          |     | Video Input Interface (ch) | Video Output Interface (ch) | PCI Express® (lane) | UART (ch) | SPI (ch) | I²C (ch) | CAN (ch) | CAN FD (ch) | PCM (ch) | Memory Controller                  | CPU Core                                  |                                        | Package   |
|-----------------|--|-----------------------------------------------|-----------------------------------------------------------|-------------------------------|------------------------------|---------|--------|-----------|---------------------------------------|----------------|----------|-----|----------------------------|-----------------------------|---------------------|-----------|----------|----------|----------|-------------|----------|------------------------------------|-------------------------------------------|----------------------------------------|-----------|
|                 |  |                                               |                                                           |                               | Affine Transformation        | Pyramid | Filter | Histogram | Histogram of Oriented Gradients [HOG] | Enhanced CoHOG | Matching | SfM |                            |                             |                     |           |          |          |          |             |          |                                    | Toshiba's Proprietary 32-bit RISC CPU MeP | ARM 32-bit RISC ARM® Cortex®-A9 MPCore |           |
| TMPV7502XBG ☆   |  | 266.7                                         | —                                                         | ○                             | ○                            | —       | ○      | ○         | ○                                     | —              | ○        | —   | 1                          | 1                           | —                   | 5         | 1        | 4        | 2        | —           | 2        | DDR2-SDRAM, SRAM, ROM, NOR Flash   | ○                                         | —                                      | PLFBGA324 |
| TMPV7504XBG ☆   |  | 266.7                                         | —                                                         | ○                             | ○                            | —       | ○      | ○         | —                                     | —              | ○        | —   | 2                          | 1                           | —                   | 5         | 4        | 4        | 3        | —           | 2        | DDR2-SDRAM, SRAM, ROM, NOR Flash   | ○                                         | —                                      | PBGA516   |
| TMPV7506XBG ☆   |  | 266.7                                         | —                                                         | ○                             | ○                            | —       | ○      | ○         | ○                                     | —              | ○        | —   | 4                          | 1                           | 1                   | 5         | 4        | 4        | 3        | —           | 2        | DDR2-SDRAM, SRAM, ROM, NOR Flash   | ○                                         | —                                      | PBGA516   |
| TMPV7528XBG ☆   |  | 266.7                                         | 300                                                       | ○                             | ○                            | —       | ○      | ○         | ○                                     | —              | ○        | —   | 4                          | 1                           | 1                   | 5         | 4        | 4        | 3        | —           | 2        | DDR2-SDRAM, SRAM, ROM, NOR Flash   | ○                                         | ○                                      | PBGA516   |
| TMPV7602XBG **☆ |  | 266.7                                         | —                                                         | ○                             | ○                            | ○       | ○      | ○         | ○                                     | ○              | ○        | —   | 2                          | 1                           | —                   | 5         | 4        | 4        | 2        | 2           | 2        | LPDDR2-SDRAM, SRAM, ROM, NOR Flash | ○                                         | —                                      | PLFBGA521 |
| TMPV7608XBG ☆   |  | 266.7                                         | —                                                         | ○                             | ○                            | ○       | ○      | ○         | ○                                     | ○              | ○        | ○   | 8                          | 2                           | —                   | 5         | 4        | 8        | 3        | —           | 2        | LPDDR2-SDRAM SRAM, ROM, NOR Flash  | ○                                         | —                                      | PFBGA796  |

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Automotive Display Controllers / 車載ディスプレイコントローラ

| Part Number      |  | Maximum Operating Frequency (MHz) | 3D Graphic Accelerator | 2D Graphic Accelerator | Display Controller (ch) | Video Capture (ch) | Stepper Motor Controller (ch) | DMAC (ch) | UART (ch) | SPI (ch) | I²C (ch) | CAN (ch) | Timer (ch) | PWM (ch) | ADC (ch) | Memory Controller                                   | Others                                              | Package |
|------------------|--|-----------------------------------|------------------------|------------------------|-------------------------|--------------------|-------------------------------|-----------|-----------|----------|----------|----------|------------|----------|----------|-----------------------------------------------------|-----------------------------------------------------|---------|
|                  |  |                                   |                        |                        |                         |                    |                               |           |           |          |          |          |            |          |          |                                                     |                                                     |         |
| TX4961XBG-240 ☆  |  | 240                               | —                      | ○                      | 1                       | 1                  | —                             | 8         | 3         | 2        | 1        | 3        | 8          | 6        | 8        | NAND Flash, DDR-SDRAM, SRAM, ROM, NOR Flash         | MLB, AC-link controller                             | PBGA456 |
| TX4964FG-120 ☆   |  | 120                               | —                      | ○                      | 1                       | 1                  | —                             | 4         | 2         | 2        | 1        | 2        | 5          | 3        | —        | SRAM, ROM, NOR Flash                                | Embedded DRAM: 4 MBytes, I²S: 2 ch                  | LQFP176 |
| TX4966XBG-280 ☆  |  | 280                               | ○                      | ○                      | 2                       | 2                  | —                             | 8         | 2         | 4        | 1        | 4        | 19         | 14       | —        | SDRAM, SRAM, ROM, NOR Flash                         | Embedded DRAM: 8 MBytes, APiX: 2 ch, MLB, I²S: 2 ch | PBGA456 |
| TMPR460XBG-300 ☆ |  | 300                               | —                      | ○                      | 1                       | 1                  | 4                             | 8         | 2         | 2        | 1        | 2        | 10         | 10       | 8        | Q-SPI Flash, LPDDR/SDRAM, SRAM, ROM, NAND/NOR Flash | I²S: 2 ch, RTC, Voltage regulator                   | PBGA244 |
| TMPR461XBG-300 ☆ |  | 300                               | —                      | ○                      | 2                       | 1                  | 5                             | 8         | 2         | 2        | 1        | 3        | 10         | 24       | 14       | Q-SPI Flash, LPDDR/SDRAM, SRAM, ROM, NAND/NOR Flash | I²S: 2 ch, MLB, RTC, Voltage regulator              | PBGA328 |

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## Automotive Video Processors / 車載ディスプレイ用映像処理 IC (Dual/Single-Picture Video Processors) / (2画面/単画面映像処理 IC)

| Part Number     | Function                                        | Package  | ADC | Color Decoder | Overlay | Muteless Input Switch | New Picture Adjustment | LVDS Input I/F | Two Digital Video Output | Panel   | Operating Temperature (°C) | Supply Voltage (V)                     |
|-----------------|-------------------------------------------------|----------|-----|---------------|---------|-----------------------|------------------------|----------------|--------------------------|---------|----------------------------|----------------------------------------|
| TC90195XBG ☆    | Dual pictures processing                        | LFBGA293 | 1   | 1             | ○       | ○                     | ○                      | ○              | ○                        | WXGA+   | -40 to +85                 | 1.1 to 1.3<br>3.0 to 3.6               |
| TC90175XBG ** ☆ | Picture processing                              | LFBGA293 | 1   | 1             | —       | ○                     | ○                      | ○              | ○                        | Full-HD |                            |                                        |
| TC90197XBG ☆    | Dual pictures processing                        | LBGA 256 | 4   | 2             | ○       | —                     | ○                      | —              | —                        | WVGA    |                            | 1.4 to 1.6<br>2.3 to 2.7<br>3.0 to 3.6 |
| TC90193SBG ☆    | Quick display function for Rear view monitor    | FBGA228  | 1   | 1             | —       | —                     | ○                      | —              | —                        |         |                            |                                        |
| TC90193ASBG ☆   |                                                 |          | 1   | 1             | —       | ○                     | ○                      | —              | —                        |         |                            |                                        |
| TC90202XBG ☆    | LCD Timing control & Picture quality adjustment | FBGA121  | —   | —             | —       | —                     | ○                      | —              | —                        |         |                            | 1.4 to 1.6<br>3.0 to 3.6               |
| TC90205FG ☆     |                                                 | LQFP80   | —   | —             | —       | —                     | ○                      | —              | —                        |         |                            |                                        |
| TC90207FG ☆     | LVDS to LVTTTL                                  | LQFP64   | —   | —             | —       | —                     | —                      | ○              | —                        |         |                            |                                        |

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## (Video Decoder ICs) / (ビデオデコーダ IC)

| Part Number  | Function                           | Package | ADC | Color Decoder | Component Input (D2) | New Picture Adjustment | ITU-R BT.601 Output | ITU-R BT.656 Output | 8 bit Serial Output (D2) | Operating Temperature (°C) | Supply Voltage (V)                     |
|--------------|------------------------------------|---------|-----|---------------|----------------------|------------------------|---------------------|---------------------|--------------------------|----------------------------|----------------------------------------|
| TC90104AFG ☆ | Video Decoder                      | LQFP64  | 3   | 1             | ○                    | —                      | ○                   | ○                   | ○                        | -40 to +85                 | 1.4 to 1.6<br>2.3 to 2.7<br>3.0 to 3.6 |
| TC90106FG ☆  |                                    |         | 3   | 1             | ○                    | —                      | —                   | ○                   | ○ Embedded SAV/EAV       |                            |                                        |
| TC90105FG ☆  | Video Decoder with 2.5 V regulator | LQFP80  | 2   | 2             | —                    | ○                      | ○                   | ○                   | —                        |                            |                                        |
| TC90107FG ☆  |                                    | LQFP64  | 1   | 1             | —                    | ○                      | —                   | ○                   | —                        |                            |                                        |

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## System Power Supplies / システム電源

| Part Number    | Package       | Functions                                                                                                            | Characteristics            |                       |                           | Remarks                                                                                                                                                  | Supply Voltage (V) |
|----------------|---------------|----------------------------------------------------------------------------------------------------------------------|----------------------------|-----------------------|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
|                |               |                                                                                                                      | Output Voltage Typ. (V)    | Input Voltage Max (V) | Power Dissipation Max (W) |                                                                                                                                                          |                    |
| TB9004FNG      | SSOP24 (0.65) | 2 ch CPU voltage regulators<br>Watchdog timer                                                                        | 3.4/2.5/1.5<br>5           | 45 (1 s)              | 0.85                      | Watchdog timer enable/disable<br>All regulators enable/disable<br>5 V regulator enable/disable<br>2 reset outputs<br>External transistor required        | 6 to 16            |
| TB9005FNG ☆    | SSOP20 (0.65) | CPU voltage regulator<br>Watchdog timer                                                                              | 5                          | 45 (60 s)             | 0.6                       | Low current consumption: 90 μA (typ.)<br>Watchdog timer enable/disable<br>Reset detection: 4.75 V or 4.25 V (selectable)<br>External transistor required | 6 to 18            |
| TB9021FNG ☆    | HTSSOP16      | CPU voltage regulator<br>Watchdog timer                                                                              | 5                          | 50                    | 2.8                       | Low current consumption: 30 μA (typ.)<br>Output transistors included<br>Window watchdog timer<br>Reset detection: 4.7 V or 4.2 V (selectable)            | 6 to 18            |
| TB9042FTG ** ☆ | HQFN52        | CPU voltage regulator<br>Switching regulators<br>Series regulators<br>Watchdog timer<br>SPI communications           | 1.5/1.2<br>5<br>5<br>5/3.3 | 40 (1 s)              | 5.5                       | 2 switching regulators<br>1.2 V/1.5 V selectable<br>3 series regulators<br>2 watchdog timers<br>SPI communications<br>Diagnosis functions                | 7 to 20.1          |
| TB9044FNG ** ☆ | HTSSOP48      | CPU voltage regulator<br>Switching regulator<br>Series regulator<br>Trackers<br>Watchdog timer<br>SPI communications | 5<br>5<br>5<br>5           | 40 (1 s)              | 3.84                      | Buck/Boost Switching regulator<br>1 series regulator<br>3 trackers<br>1 watchdog timer<br>SPI communications<br>Diagnosis functions                      | 2.7 to 18          |

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## Blushed DC Motor Driver ICs / ブラシ付きモータドライバ

| Part Number     | Package        | Functions                                         | Remarks                                                                                                                               | Output Current Max (A) | Supply Voltage (V) |
|-----------------|----------------|---------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|------------------------|--------------------|
| TB9051FTG ☆     | PQFN28 (0.65)  | 1-ch H-bridge driver                              | PWM control, Small package, Built-in overcurrent detection, etc.                                                                      | 5                      | 4.5 to 28          |
| TB9052FNG ☆     | HTSSOP48 (0.5) | H-bridge pre-driver                               | High speed pre-driver = 250 ns (typ.)<br>High speed current monitor = 3 V/μs (min)<br>Sequence control logic<br>Diagnostic function   | 1                      | 6 to 18            |
| TB9056FNG ☆     | SSOP24 (0.65)  | LIN-compatible H-bridge driver                    | LIN Rev. 1.3<br>Motor driver: ROSON (H bridge: P-ch + N-ch) = 2.2 Ω (typ.)<br>Potentiometer support                                   | 0.3                    | 7 to 18            |
| TB9057FG ☆      | LQFP48 (0.5)   | H-bridge pre-driver                               | High speed pre-driver = 250 ns (typ.)<br>High speed current monitor = 3 V/μs (min)<br>Motor rotation detection<br>Diagnostic function | 1                      | 5 to 21            |
| TB9101FNG ☆     | SSOP24 (0.65)  | 2-ch H-bridge driver                              | Diagnostic function, standby function,<br>P-ch + N-ch = 1.2 Ω (typ.)                                                                  | 1                      | 7 to 18            |
| TB9102FNG ☆     | SSOP24 (0.65)  | 6-ch Half-bridge driver /<br>3-ch H-bridge driver | SPI communications, Diagnosis function<br>P-ch + N-ch = 1.0 Ω (typ.)                                                                  | 1                      | 7 to 18            |
| TB9110FNG ☆     | SSOP24 (0.65)  | N-ch MOS gate driver                              | Diagnosis function and standby function,<br>Built-in charge pump, Ta = 105°C                                                          | 0.02 <sup>(1)</sup>    | 7 to 18            |
| TB9110AFNG ** ☆ | SSOP24 (0.65)  | N-ch MOS gate driver                              | Diagnosis function and standby function,<br>Built-in charge pump, Ta = 125°C                                                          | 0.02 <sup>(1)</sup>    | 7 to 18            |

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Note (1): An external N-channel FET is required as a gate driver. / Gate Driver: 外付け Nch-FET 使用。

## Stepping Motor Driver ICs / ステッピングモータドライバ

| Part Number    | Package                   | Functions                                                   | Remarks                                                                                                             | Output Current Max (A) | Supply Voltage (V) |
|----------------|---------------------------|-------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|------------------------|--------------------|
| TB9120FTG ** ☆ | QFN28 (Wettable half cut) | 2-Phase Bipolar stepping motor driver (Clock-in controlled) | PWM controlled constant-current drive 1/32 microstep (maximum resolution), stall detect features and Mix DECAY mode | 1                      | 7.0 to 18          |

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## Brushless Motor Driver ICs / ブラシレスモータドライバ

| Part Number   | Package       | Functions                                                  | Characteristics                                                                                                                                                                                                                                                                                                                                     | Supply Voltage (V) |
|---------------|---------------|------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| TB9061FNG ☆   | SSOP24 (0.65) | Sensorless control with 120 degree commutation, Pre-driver | 3-phase, full-wave sensorless drive<br>PWM pulse input control/DC level input control (selectable)<br>Comparator for induced voltage detection<br>Thermal shutdown, overcurrent detection, overvoltage detection                                                                                                                                    | 5.5 to 18          |
| TB9061AFNG ☆  | SSOP24 (0.65) | Sensorless control with 120 degree commutation, Pre-driver | 3-phase, full-wave sensorless drive<br>PWM pulse input control/DC level input control (selectable)<br>Comparator for induced voltage detection<br>Thermal shutdown, overcurrent detection, overvoltage detection<br>Output PWM Dynamic range expansion                                                                                              | 5.5 to 18          |
| TB9067FNG ☆   | SSOP24 (0.65) | Hall IC, Pre-driver for 120 degree commutation             | 120-degree commutation logic<br>Pre-drivers for a high-side P-ch FET and a low-side N-ch FET<br>PWM pulse input control/DC level input control (selectable)<br>Two options for setting the output duty cycle (pulse input, analog input)<br>Overcurrent detection, thermal shutdown, supply voltage increase, supply voltage decrease<br>Soft start | 6 to 18            |
| TB9068FG ☆    | LQFP48 (0.5)  | Motor driver with a LIN transceiver                        | Motor driver R <sub>DS(on)</sub> : P-ch = 1 Ω (typ.), N-ch = 1 Ω (typ.)<br>120-degree commutation logic<br>LIN 1.3-based transceiver<br>5-V supply for a microcontroller (external PNP transistor required)<br>Watchdog timer, power-on reset timer<br>Three analog comparators for Hall devices                                                    | 7 to 18            |
| TB9080FG ☆    | LQFP64 (0.5)  | Hall elements, Pre-driver for sine-wave control            | Supports both PWM and DC inputs for sine-wave driver logic.<br>Motor RPM feedback, auto lead angle correction<br>Abnormal condition detection such as overcurrent, overvoltage, overtemperature and motor lock<br>Sleep mode                                                                                                                        | 7 to 18            |
| TB9081FG ** ☆ | LQFP64 (0.5)  | 3-Phase Brushless Motor Pre-driver                         | 5-channel safety relay<br>Selectable operation on fault detection<br>Initial diagnosis of detection circuits                                                                                                                                                                                                                                        | 4.5 to 18          |

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## IGBT Gate-Pre Driver Control IC / IGBT ゲートプリドライバコントロールIC

| Part Number    | Package      | Functions                                                                                                                                  | Characteristics                                                                                                                                  | Supply Voltage (V)                                                                    |
|----------------|--------------|--------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| TB9150FNG ** ☆ | SSOP48 (0.5) | IGBT Gate-Pre driver control IC for in-vehicle inverters, Built-in isolation device (optical coupling) for primary-side and secondary-side | IGBT Gate-Pre driver control, IGBT temperature monitor, Short circuit detection (current sense, DESAT), UVLO, etc., Built-in fly-back controller | 6 to 20<br>(GND1 Standard, Primary-side)<br>11 to 18<br>(VE Standard, Secondary-side) |

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## Interface Bridges / インタフェースブリッジ

| Part Number     | Package          | Applications                                             | Functions and Features                                                                                                                                                                                                                                                   | Supply Voltage (V)                                                           |
|-----------------|------------------|----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| TC9560XBG ** ☆  | PLFBGA170 (0.65) | Ethernet AVB Bridge Solution For Automotive Applications | Host (External application) I/F: PCIe I/F [Gen2.0 (5 GT/s), Endpoint, Single lane],<br>Automotive I/F: Ethernet AVB [IEEE802.1AS, IEEE802.1Qav], MAC<br>Audio I/F: I2S/TDM<br>Peripheral I/F: I2C/SPI, Quad-SPI, UART, GPIO, INTC<br>CPU Core: ARM Cortex-M3             | 1.8/3.3 for IO<br>1.8/2.5/3.3 for RGMII/RMII<br>1.1 for Core                 |
| TC9560AXBG ** ☆ | PLFBGA170 (0.65) | Ethernet AVB Bridge Solution For Automotive Applications | Host (External application) I/F: PCIe I/F [Gen2.0 (5 GT/s), Endpoint, Single lane],<br>Automotive I/F: Ethernet AVB [IEEE802.1AS, IEEE802.1Qav], MAC, 2ch CAN-FD<br>Audio I/F: I2S/TDM<br>Peripheral I/F: I2C/SPI, Quad-SPI, UART, GPIO, INTC<br>CPU Core: ARM Cortex-M3 | 1.8/3.3 for IO<br>1.8/2.5/3.3 for RGMII/RMII<br>1.1 for Core                 |
| TC9560BxBG ** ☆ | PLFBGA170 (0.65) | Ethernet AVB Bridge Solution For Automotive Applications | Host (External application) I/F: HSIC I/F (480 Mbps)<br>Automotive I/F: Ethernet AVB [IEEE802.1AS, IEEE802.1Qav], MAC, 2ch CAN-FD<br>Audio I/F: I2S/TDM<br>Peripheral I/F: I2C/SPI, Quad-SPI, UART, GPIO, INTC<br>CPU Core: ARM Cortex-M3                                | 1.8/3.3 for IO<br>1.2 for HSIC<br>1.8/2.5/3.3 for RGMII/RMII<br>1.1 for Core |

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Communications ICs / 通信用

Wireless Communications ICs / 無線通信用 IC

| Part Number  | Package<br>(Pin Pitch) | Functions | Applications                                                                                                         | Functions and Features                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                     | Supply<br>Voltage<br>(V)                                                                                                                     |
|--------------|------------------------|-----------|----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| TC32306FTG ☆ | QFN36 (0.5 mm)         | RF- IC    | Remote keyless entry (remote door lock/unlock), TPMS (tire pressure monitoring system), Remote control (AM/FM), etc. | Single-chip RF transceiver;<br>Supported modulation: ASK/FSK.<br>Use for four RF Band: 315, 434, 868/915-MHz,<br>Fractional-N ΔΣ PLL<br>Receiver sensitivity: under −116 dBm (At IF BW = 320 kHz, data rate = 600 Hz, frequency deviation = +/-40 kHz)<br>Transmitter power: +10 dBm (typ. by maximum coarse step control)<br>Two IF Filter bandwidths:<br>wide 320 kHz (typ.) at IF = 230 kHz/<br>middle 270 kHz (typ.) at IF = 280 kHz<br>Signal Detection: RSSI detection, noise detection (only for FSK), preamble detection<br>Serial control (4 wire SPI) /EEPROM control<br>(This IC also can be used as a specialized for receiving.) | Current consumption | TX: 12 mA (typ. /@Output level: +10 dBm)<br>RX: 9.7 mA (typ.)<br>Battery Saving: 0 μA (typ.)<br><br>3V Use: 2.0 to 3.3<br>5V Use: 2.4 to 5.5 |
| TC32163FG ☆  | LQFP48 (0.5 mm)        |           | DSRC (Dedicated Short Range Communication), ETC (Electronic Toll Collection System)                                  | 5.8-GHz transceiver;<br>ASK/QPSK, transmit power = −15 dBm to −2 dBm<br>Transmitter EVM = 6.5% (typ.)<br>ACPR 45 MHz = −42 dBc (typ.), receiver EVM = 8% (typ.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                     | RX (ASK/QPSK): 62 mA/66 mA (typ.)<br>TX (ASK/QPSK): 75 mA/75 mA (typ.)<br><br>2.7 to 3.6                                                     |
| TC32166FNG ☆ | SSOP10 (0.65 mm)       |           | DSRC (Dedicated Short Range Communication), ETC (Electronic Toll Collection System)                                  | 5.8-GHz power amp;<br>Power gain = 20 dB (typ.),<br>ACPR (ASK/QPSK, 45 MHz) = −44 dBc (@Output level: +14 dBm)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                     | TX: 75 mA (typ. /@Output level: +14 dBm)<br><br>3.0 to 3.6                                                                                   |
| TC32168FTG ☆ | QFN32 (0.5 mm)         |           | ETC (Electronic Toll Collection System) for China                                                                    | Single-Chip 5.8 G Hz transceiver including Wakeup function and FM0 Modem<br>Supported modulation: ASK/OOK<br>Receiving sensitivity: −60 dBm (typ.)<br>Wakeup sensitivity: −45 dBm (typ.)<br>Transmit power: +3 dBm                                                                                                                                                                                                                                                                                                                                                                                                                            |                     | Sleep: 5 μA<br>RX: 30 mA (typ.)<br>TX: 35 mA (typ.)<br><br>1.8 to 3.6                                                                        |

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Proximity Wireless Compliant Products / 近接無線対応製品

| Part Number   | Package | Applications                   | Functions and Features                                                                                      | Supply<br>Voltage<br>(V) |
|---------------|---------|--------------------------------|-------------------------------------------------------------------------------------------------------------|--------------------------|
| TC35420AXLG ☆ | WFLGA81 | Proximity wireless transceiver | TransferJet™-compliant Wireless IC<br>On-chip RF circuitry, digital signal processing<br>SDIO UHS-I support | 3.3 to 1.8               |
| TJM35420XLQ ☆ | LGA68   | Proximity wireless transceiver | TransferJet™-compliant Wireless Module<br>Built-in RF components<br>SDIO UHS-I support                      | 3.3 to 1.8               |

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## Bluetooth® ICs / Bluetooth® IC

(Bluetooth® Classic / Bluetooth® Classic\_low energy dual ICs for Consumer) /

(民生用Bluetooth® Classic / Bluetooth® Classic low energy dual IC)

| CPU         | Host-IF | Other Interfaces           |
|-------------|---------|----------------------------|
| ARM7TDMI-S™ | UART    | I <sup>2</sup> C/SPI /GPIO |

| Part Number        | Bluetooth Core Spec.            | Profiles       | Features                                                                                                                                                                             | Operating temperature (°C) | Supply Voltage (V)       | Package                                 |
|--------------------|---------------------------------|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|--------------------------|-----------------------------------------|
| TC35661SBG-203 ☆   | Ver.4.2 Classic                 | SPP            | • Receiver sensitivity –90 dBm<br>• Transmit power 2 dBm<br>• Current consumption in TX/RX (peak) 63 mA<br>• Current consumption in deep sleep mode 30 µA                            | –40 to +85                 | 1.7 to 1.9 or 2.7 to 3.6 | BGA64 (0.5 mm Pitch)<br>5.0 mm x 5.0 mm |
| TC35661SBG-007 ☆   |                                 | HCI            | • Receiver sensitivity –91 dBm<br>• Transmit power 2 dBm<br>• Current consumption in TX/RX (peak) 63 mA<br>• Current consumption in deep sleep mode 30 µA<br>• Wide band Speech      |                            |                          | BGA64 (0.8 mm Pitch)<br>7.0 mm x 7.0 mm |
| TC35661DBG-008 ☆   |                                 |                |                                                                                                                                                                                      |                            |                          |                                         |
| TC35661SBG-009 ☆ * | Ver.4.2 Classic/low energy dual |                |                                                                                                                                                                                      |                            |                          | BGA64 (0.5 mm Pitch)<br>5.0 mm x 5.0 mm |
| TC35661SBG-501 ☆   | Ver.4.0 Classic/low energy dual | SPP, GATT, SMP | • Receiver sensitivity –90 dBm<br>• Transmit power 2 dBm<br>• Current consumption in TX/RX (peak) 63 mA<br>• Current consumption in deep sleep mode 30 µA                            |                            |                          | BGA64 (0.5 mm Pitch)<br>5.0 mm x 5.0 mm |
| TC35661SBG-502 ☆   |                                 |                |                                                                                                                                                                                      |                            |                          | BGA64 (0.8 mm Pitch)<br>7.0 mm x 7.0 mm |
| TC35661DBG-501 ☆   |                                 |                |                                                                                                                                                                                      |                            |                          |                                         |
| TC35661SBG-503 ☆   | Ver.4.2 Classic/low energy dual |                | • Receiver sensitivity –91 dBm<br>• Transmit power 2 dBm<br>• Current consumption in TX/RX (peak) 63 mA<br>• Current consumption in deep sleep mode 30 µA                            |                            |                          | BGA64 (0.5 mm Pitch)<br>5.0 mm x 5.0 mm |
| TC35661SBG-551 ☆ * |                                 |                | • Receiver sensitivity –91 dBm<br>• Transmit power 1 dBm<br>• Current consumption in TX/RX (peak) 63 mA<br>• Current consumption in deep sleep mode 30 µA<br>• LE Secure Connections |                            |                          |                                         |

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## Bluetooth® ICs / Bluetooth® IC

(Bluetooth® low energy ICs for Consumer) / (民生用Bluetooth® low energy IC)

| Host-IF | Other Interfaces          | Other functions |
|---------|---------------------------|-----------------|
| UART    | I <sup>2</sup> C/SPI/GPIO | ADC/PWM/DC-DC   |

| Part Number         | Bluetooth Core Spec. | Profiles       | NFC Tag | CPU              | Features                                                                                                                                                                                                                                             | Operating temperature (°C)                                                                                                                                                                                                                                                                                                              | Supply Voltage (V) | Package                              |                                      |
|---------------------|----------------------|----------------|---------|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------------------------|--------------------------------------|
| TC35667FTG-005 ☆    | Ver.4.0 low energy   | HCI, GATT, SMP |         | ARM® ARM7TDMI-S™ | <ul style="list-style-type: none"><li>Receiver sensitivity –92 dBm</li><li>Transmit power 0 dBm</li><li>Current consumption in TX/RX (peak) 5.9 mA (3.3 V, –4 dBm TX power)/ 5.7 mA</li><li>Current consumption in deep sleep mode 0.05 μA</li></ul> | –40 to +85                                                                                                                                                                                                                                                                                                                              | 1.8 to 3.6         | QFN40 (0.5 mm Pitch) 6.0 mm x 6.0 mm |                                      |
| TC35670FTG-005 ☆    |                      |                | ✓       |                  |                                                                                                                                                                                                                                                      | –30 to +85                                                                                                                                                                                                                                                                                                                              |                    |                                      |                                      |
| TC35667FTG-006 ☆    | Ver.4.1 low energy   |                |         |                  | ARM® ARM7TDMI-S™                                                                                                                                                                                                                                     | <ul style="list-style-type: none"><li>Receiver sensitivity –92 dBm</li><li>Transmit power 0 dBm</li><li>Current consumption in TX/RX (peak) 5.9 mA (3.3 V, –4 dBm TX power)/ 5.7 mA</li><li>Current consumption in deep sleep mode 0.05 μA</li><li>Scatternet</li></ul>                                                                 |                    | –40 to +85                           | QFN40 (0.5 mm Pitch) 6.0 mm x 6.0 mm |
| TC35670FTG-006 ☆    |                      |                | ✓       |                  |                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                         |                    | –30 to +85                           | QFN40 (0.5 mm Pitch) 6.0 mm x 6.0 mm |
| TC35676FSG-001 ☆    |                      |                |         |                  |                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                         |                    | –40 to +85                           | QFN40 (0.4 mm Pitch) 5.0 mm x 5.0 mm |
| TC35675XBG-001 ☆    |                      |                | ✓       |                  |                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                         |                    |                                      | BGA52 (0.5 mm Pitch) 4.5 mm x 4.5 mm |
| TC35678FSG-002 ☆ *  | Ver.4.2 low energy   |                |         |                  | Cortex®-M0                                                                                                                                                                                                                                           | <ul style="list-style-type: none"><li>Receiver sensitivity –93.5 dBm</li><li>Transmit power 0 dBm</li><li>Current consumption in TX/RX (peak) 3.3 mA (3.0 V, 0 dBm TX power)/ 3.3 mA</li><li>Current consumption in deep sleep mode 0.05 μA</li><li>Scatternet</li><li>LE Data Length Extension</li><li>LE Secure Connections</li></ul> | –40 to +85         | QFN40 (0.4 mm Pitch) 5.0 mm x 5.0 mm |                                      |
| TC35678FXG-002 ☆ *  |                      |                |         |                  |                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                         |                    |                                      | QFN60 (0.4 mm Pitch) 7.0 mm x 7.0 mm |
| TC35679FSG-002 ☆ *  |                      |                |         |                  |                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                         |                    |                                      | QFN40 (0.4 mm Pitch) 5.0 mm x 5.0 mm |
| TC3567CFSG-001 ☆ ** |                      |                |         |                  |                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                         |                    |                                      |                                      |
| TC3567DFSG-001 ☆ ** |                      |                |         |                  |                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                         |                    |                                      |                                      |

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\*\* : Under development / 開発中

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(Bluetooth® Classic / Bluetooth® Classic\_low energy dual / Bluetooth® low energy ICs for Automotive) /  
(車載用Bluetooth® Classic / Bluetooth® Classic\_low energy dual / Bluetooth® low energy IC)

| Part Number          | Bluetooth Core Spec.            | Profiles                    | Features                                                                                                                                                                                                                                                                                                                                | Operating temperature (°C) | Supply Voltage (V) | Package                                 |
|----------------------|---------------------------------|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|--------------------|-----------------------------------------|
| TC35661IDBG-203 ☆    | Ver.4.2 Classic                 | SPP                         | <ul style="list-style-type: none"><li>Receiver sensitivity –90 dBm</li><li>Transmit power 2 dBm</li><li>Current consumption in TX/RX (peak) 63 mA</li><li>Current consumption in deep sleep mode 30 μA</li></ul>                                                                                                                        | –40 to +85                 | 2.7 to 3.6         | BGA64 (0.8 mm Pitch)<br>7.0 mm x 7.0 mm |
| TC35661IDBG-007 ☆    |                                 | HCI                         | <ul style="list-style-type: none"><li>Receiver sensitivity –90 dBm</li><li>Transmit power 2 dBm</li><li>Current consumption in TX/RX (peak) 63 mA</li><li>Current consumption in deep sleep mode 30 μA</li><li>Wide band Speech</li></ul>                                                                                               |                            |                    |                                         |
| TC35661IDBG-008 ☆    |                                 |                             | <ul style="list-style-type: none"><li>Receiver sensitivity –91 dBm</li><li>Transmit power 2 dBm</li><li>Current consumption in TX/RX (peak) 63 mA</li><li>Current consumption in deep sleep mode 30 μA</li><li>Wide band Speech</li></ul>                                                                                               |                            |                    |                                         |
| TC35661IDBG-009 ☆ ** | Ver.4.2 Classic/low energy dual |                             | <ul style="list-style-type: none"><li>Receiver sensitivity –91 dBm</li><li>Transmit power 2 dBm</li><li>Current consumption in TX/RX (peak) 63 mA</li><li>Current consumption in deep sleep mode 30 μA</li><li>Wide band Speech</li></ul>                                                                                               |                            |                    |                                         |
| TC35661IDBG-503 ☆ ** |                                 | SPP, GATT, SMP              | <ul style="list-style-type: none"><li>Receiver sensitivity –91 dBm</li><li>Transmit power 2 dBm</li><li>Current consumption in TX/RX (peak) 63 mA</li><li>Current consumption in deep sleep mode 30 μA</li></ul>                                                                                                                        |                            |                    |                                         |
| TC35668IXBG ☆        | Ver.4.0 Classic                 | HFP, A2DP, AVRCP, PBAP, SPP | <ul style="list-style-type: none"><li>Receiver sensitivity –93 dBm</li><li>Transmit power 1 dBm</li><li>Current consumption in TX/RX (peak) 174 mA</li><li>On-chip DSP</li><li>Wide band Speech</li></ul>                                                                                                                               | –40 to +105                | 3.0 to 3.6         | BGA97 (0.5 mm Pitch)<br>6.0 mm x 6.0 mm |
| TC35667IFTG-005 ☆    | Ver.4.0 low energy              | HCI, GATT, SMP              | <ul style="list-style-type: none"><li>Receiver sensitivity –92 dBm</li><li>Transmit power 0 dBm</li><li>Current consumption in TX/RX (peak) 5.9 mA (3.3 V, –4 dBm TX power)/ 5.7 mA</li><li>Current consumption in deep sleep mode 0.05 μA</li></ul>                                                                                    |                            | 1.8 to 3.6         | QFN40 (0.5 mm Pitch)<br>6.0 mm x 6.0 mm |
| TC35667IFTG-006 ☆ ** | Ver.4.1 low energy              |                             | <ul style="list-style-type: none"><li>Receiver sensitivity –92 dBm</li><li>Transmit power 0 dBm</li><li>Current consumption in TX/RX (peak) 5.9 mA (3.3 V, –4 dBm TX power)/ 5.7 mA</li><li>Current consumption in deep sleep mode 0.05 μA</li><li>Scatternet</li></ul>                                                                 |                            |                    |                                         |
| TC35679IFTG-002 ☆ ** | Ver.4.2 low energy              |                             | <ul style="list-style-type: none"><li>Receiver sensitivity –93.5 dBm</li><li>Transmit power 0 dBm</li><li>Current consumption in TX/RX (peak) 3.3 mA (3.0 V, 0 dBm TX power)/ 3.3 mA</li><li>Current consumption in deep sleep mode 0.05 μA</li><li>Scatternet</li><li>LE Data Length Extension</li><li>LE Secure Connections</li></ul> |                            |                    |                                         |

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\*\*: Under development / 開発中



## TV and Audio ICs / テレビ/オーディオ用

### TV Tuning & Channel Decoder ICs / TVチューナ/伝送復調用IC (Channel Decoder ICs) / (伝送復調用IC)

| Part Number  | Package | Use                                                         | Features                                                                                                                                                                                                                | Supply Voltage (V)       |
|--------------|---------|-------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| TC90532XBG ☆ | FBGA177 | 8PSK demodulator<br>OFDM demodulator                        | Digital BS broadcasting, digital CS broadcasting (ISDB-S),<br>8PSK, QPSK demodulation, error correction,<br>Digital terrestrial broadcasting (ISDB-T),<br>OFDM demodulation, error correction,<br>A/D converter, memory | 3.0 to 3.6<br>1.1 to 1.3 |
| TC90522XBG ☆ | FBGA177 | 8PSK demodulator<br>OFDM demodulator<br>(Two channels each) | Digital BS broadcasting, digital CS broadcasting (ISDB-S),<br>8PSK, QPSK demodulation, error correction,<br>Digital terrestrial broadcasting (ISDB-T),<br>OFDM demodulation, error correction,<br>A/D converter, memory | 3.0 to 3.6<br>1.1 to 1.3 |
| TC90527AFG ☆ | LQFP48  | OFDM demodulator                                            | Digital terrestrial broadcasting (ISDB-T),<br>OFDM demodulation, error correction,<br>A/D converter, memory                                                                                                             | 3.0 to 3.6<br>1.1 to 1.3 |

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### Audio ICs / オーディオ用IC (Power Amp ICs) / (パワーアンプIC)

| Part Number | Package  | Intended Use |              | Output Power (P <sub>OUT</sub> ) |                                   |                                   | Features                                                                                                                                                                                                                                                                                                                                  | Supply Voltage (V)                                               |
|-------------|----------|--------------|--------------|----------------------------------|-----------------------------------|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
|             |          | Car Stereos  | Engine Sound | Recommended V <sub>CC</sub>      | R <sub>L</sub> = 4 Ω<br>THD = 10% | R <sub>L</sub> = 8 Ω<br>THD = 10% |                                                                                                                                                                                                                                                                                                                                           |                                                                  |
| TB2909FNG   | HTSSOP16 |              | ○            | 12 V                             |                                   | 2 W x 1                           | MOS amplifier for 1 SEPP channel, Standby function, Mute function, Maximum power: 5 W x 1 ch, Output short detection, Thermal detection, Speaker open detection, Overvoltage detection                                                                                                                                                    | 6 to 16                                                          |
| TB2931HQ    | SPP25    | ○            |              | 13.2 V                           | 24 W x 4                          |                                   | MOS amplifier for 4 BTL channels, Standby function, Mute function, Maximum power: 49 W x 4 ch, R <sub>L</sub> = 2 Ω operation guaranteed, Output DC offset detection, Output short detection, +B overvoltage detection, Half short detection                                                                                              | 6 to 18 (R <sub>L</sub> = 4 Ω)<br>6 to 16 (R <sub>L</sub> = 2 Ω) |
| TB2938HQ    | SPP25    | ○            |              | 13.2 V                           | 24 W x 4                          |                                   | MOS amplifier for 4 BTL channels, Standby function, Mute function, Maximum power: 49 W x 4 ch, Output DC offset detection, Output short detection, +B overvoltage detection, Half short detection, Speaker burning prevention                                                                                                             | 6 to 18                                                          |
| TB2959HQ    | SPP25    | ○            |              | 13.2 V                           | 23 W x 4                          |                                   | MOS amplifier for 4 BTL channels, Standby function, Mute function, Maximum power: 47 W x 4 ch, AUX amp, +B overvoltage detection, Speaker burning prevention                                                                                                                                                                              | 6 to 18                                                          |
| TB2941HQ    | SPP25    | ○            |              | 13.2 V                           | 24 W x 4                          |                                   | MOS amplifier for 4 BTL channels, Standby function, Mute function, Maximum power: 49 W x 4 ch, R <sub>L</sub> = 2 Ω operation guaranteed, High-side-switch, Output DC offset detection, 6 V operations (Engine idling reduction capability), Proof against from GSM                                                                       | 6 to 18 (R <sub>L</sub> = 4 Ω)<br>6 to 16 (R <sub>L</sub> = 2 Ω) |
| TB2952AHQ   | SPP25    | ○            |              | 13.2 V                           | 24 W x 4                          |                                   | MOS amplifier for 4 BTL channels, Command-controlled standby and mute mode, Hardware-standby mode, Maximum power: 49 W x 4 ch, I <sup>2</sup> C-bus controlled self-diagnosis, R <sub>L</sub> = 2 Ω operation guaranteed, Selectable voltage gain (26/12 dB), 6 V operations (Engine idling reduction capability), Proof against from GSM | 6 to 18 (R <sub>L</sub> = 4 Ω)<br>6 to 16 (R <sub>L</sub> = 2 Ω) |

## Audio ICs / オーディオ用IC

### (Power Amp ICs) / (パワーアンプIC)

| Part Number | Package | Intended Use |              | Output Power (P <sub>OUT</sub> ) |                                   |                                   | Features                                                                                                                                                                                                                                                                                                                                                                                | Supply Voltage (V)                                               |
|-------------|---------|--------------|--------------|----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
|             |         | Car Stereos  | Engine Sound | Recommended V <sub>CC</sub>      | R <sub>L</sub> = 4 Ω<br>THD = 10% | R <sub>L</sub> = 8 Ω<br>THD = 10% |                                                                                                                                                                                                                                                                                                                                                                                         |                                                                  |
| TB2975HQ    | SPP25   | ○            |              | 13.2 V                           | 24 W x 4                          |                                   | MOS amplifier for 4 BTL channels, Command-controlled standby, and mute mode, Hardware-standby mode, Maximum power: 49 W x 4 ch, Class-KB efficiency, I <sup>2</sup> C-bus controlled self-diagnosis, Cross-wiring detection, R <sub>L</sub> = 2 Ω operation guaranteed, Selectable voltage gain (26/16 dB), 6 V operations (Engine idling reduction capability), Proof against from GSM | 6 to 18 (R <sub>L</sub> = 4 Ω)<br>6 to 16 (R <sub>L</sub> = 2 Ω) |
| TB2925HQ    | SPP25   | ○            |              | 13.2 V                           | 24 W x 4                          |                                   | MOS amplifier for 4 BTL channels, Standby function, Mute function, Maximum power: 49 W x 4 ch, Class-KB efficiency, R <sub>L</sub> = 2 Ω operation guaranteed, Output DC offset detection, Output short detection, +B overvoltage detection, Cross-wiring detection, 6 V operations (Engine idling reduction capability), Proof against from GSM                                        | 6 to 18 (R <sub>L</sub> = 4 Ω)<br>6 to 16 (R <sub>L</sub> = 2 Ω) |
| TB2996HQ    | SPP25   | ○            |              | 13.2 V                           | 24 W x 4                          |                                   | MOS amplifier for 4 BTL channels, Standby function, Mute function, Maximum power: 49 W x 4 ch, R <sub>L</sub> = 2 Ω operation guaranteed, High quality sound, Output DC offset detection, Output short detection, +B overvoltage detection, 6 V operations (Engine idling reduction capability), Proof against from GSM                                                                 | 6 to 18 (R <sub>L</sub> = 4 Ω)<br>6 to 16 (R <sub>L</sub> = 2 Ω) |
| TCB001HQ    | SPP25   | ○            |              | 13.2 V                           | 22 W x 4                          |                                   | MOS amplifier for 4 BTL channels, Standby function, Mute function, Maximum power: 45 W x 4 ch, Output DC offset detection, Output short detection, +B overvoltage detection, 6 V operations (Engine idling reduction capability), Proof against from GSM                                                                                                                                | 6 to 18 (R <sub>L</sub> = 4 Ω)                                   |
| TCB501HQ    | SPP25   | ○            |              | 13.2 V                           | 24 W                              |                                   | MOS amplifier for 4 BTL channels, Standby function, Mute function, Maximum power: 49 W x 4 ch, R <sub>L</sub> = 2 Ω operation guaranteed, High-side-switch (include of back flow preventing circuit), Fulltime Output DC offset detection, 6 V operations (Engine idling reduction capability), Proof against from GSM                                                                  | 6 to 18 (R <sub>L</sub> = 4 Ω)<br>6 to 16 (R <sub>L</sub> = 2 Ω) |
| TCB502HQ    | SPP25   | ○            |              | 13.2 V                           | 24 W                              |                                   | MOS amplifier for 4 BTL channels, Standby function, Mute function, Maximum power: 49 W x 4 ch, R <sub>L</sub> = 2 Ω operation guaranteed, Full time Output DC offset detection, 6 V operations (Engine idling reduction capability), Proof against from GSM                                                                                                                             | 6 to 18 (R <sub>L</sub> = 4 Ω)<br>6 to 16 (R <sub>L</sub> = 2 Ω) |

### (Compact Disc Player IC) / (コンパクトディスクプレーヤ用IC)

| Part Number | Package | Classification        | Features                                                                                                                                                                                                                                                                                                                            | Supply Voltage (V) |
|-------------|---------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| TC94B16FG ☆ | LQFP80  | Single-chip processor | Sync separation, EFM demodulation, error detection/correction, error-corrected output, microcontroller interface, search control, digital equalizer, text data decoding, variable-speed playback, x8 oversampling digital filter, multi-bit D/A converter, head amp<br>On-chip 3.3-to-1.5-V regulator, x4 playback mode for CD-DA/R | 3.3/1.5            |

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### (CD/MP3 Player ICs) / (CDMP3 プレーヤ用IC)

| Part Number  | Package | Classification        | Features                                                                                                                                                                                                                                                  | Supply Voltage (V) |
|--------------|---------|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| TC94A92FG ☆  | LQFP80  | Single-chip processor | CD-DA/R/RW: x2 playback, low power consumption, 1-Mbit SRAM (128 Kwords x 8 bits), standby mode, Supports various compressed audio formats: MP3, WMA, AAC<br>RF amp, CD digital servo, 8fs digital filter, Multi-bit D/A converter                        | 3.3/1.5            |
| TC94A93MFG ☆ | LQFP80  | Single-chip processor | CD-DA/R/RW: x2 playback, low power consumption, 1-Mbit SRAM (128 Kwords x 8 bits), standby mode, Supports various compressed audio formats: MP3, WMA, AAC<br>RF amp, CD digital servo, 8fs digital filter<br>Multi-bit D/A converter, shock-proof feature | 3.3/1.5            |

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Application Processors / アプリケーションプロセッサ

TZ1000 Series / TZ1000 シリーズ

| Part Number | Package<br>(package size)<br>(ball pitch)    | CPU            | CPU Frequency (MHz) | SRAM (KB) | NOR Flash (MB) | Accelerometer | Gyroscope | Magnetometer | Bluetooth® core specification version | Bluetooth® Low Energy Controller | Quad SPI for Flash Connection | GPIO (ch)         | I²C (Master/Slave) (ch) | UART (ch)       | DMA (ch) | AES                         | True Random Number Generator | SPI (ch)        | PWM (ch) | 32-bit Timer | Watchdog Timer | 12-bit ADC | 24-bit ADC | USB            | Operating Temperature (°C) |
|-------------|----------------------------------------------|----------------|---------------------|-----------|----------------|---------------|-----------|--------------|---------------------------------------|----------------------------------|-------------------------------|-------------------|-------------------------|-----------------|----------|-----------------------------|------------------------------|-----------------|----------|--------------|----------------|------------|------------|----------------|----------------------------|
| TZ1011MBG   | PLFBGA153<br>(8.50 mm x 9.80 mm)<br>(0.5 mm) | ARM Cortex-M4F | 48                  | 288       | (1)<br>1       | ●             | ●         | ●            | 4.0                                   | ●                                | ●                             | (2)<br>24<br>[32] | (2)<br>2<br>[3]         | (2)<br>2<br>[3] | 8        | 128/192/256-bits key length | 1                            | (2)<br>3<br>[4] | 4        | 2            | 1              | 4          | 3          | USB 2.0 Device | Ta = -20 to 70             |
| TZ1021MBG   | PVFBGA110<br>(6.70 mm x 4.00 mm)<br>(0.4 mm) |                |                     |           |                | —             | —         | —            | —                                     | —                                |                               | 32                | 3                       | 3               |          |                             |                              | 4               |          |              |                |            |            |                |                            |
| TZ1031MBG   | PLFBGA153<br>(8.50 mm × 9.80 mm)<br>(0.5 mm) |                |                     |           |                | ●             | ●         | —            | 4.0                                   | ●                                |                               | (2)<br>24<br>[32] | (2)<br>2<br>[3]         | (2)<br>2<br>[3] |          |                             |                              | (2)<br>3<br>[4] |          |              |                |            |            |                |                            |
| TZ1041MBG   | PLFBGA136<br>(6.70 mm x 8.00 mm)<br>(0.5 mm) |                |                     |           |                | —             | —         | —            | 4.1                                   | ●                                |                               | (2)<br>24<br>[32] | (2)<br>2<br>[3]         | (2)<br>2<br>[3] |          |                             |                              | (2)<br>3<br>[4] |          |              |                |            |            |                |                            |

Note (1): NOR Flash is connected internally via SPI. / Nor FlashはSPI経由で内部接続。  
(2): Number inside the bracket means the channel counts of internal MCU. / [ ]内の数字は内蔵のMCUのチャネル数を含めた数です。

TZ1200 Series / TZ1200 シリーズ

| Part Number | Package<br>(package size)<br>(ball pitch)  | CPU            | CPU Frequency (MHz) | SRAM (MB) | e-MMC (ch) | External bus | 2D Graphics Accelerator | MIPI® DBI Type B | MIPI® DBI Type C | MIPI® DSI | Quad SPI for Flash Connection | GPIO (ch) | I²C (Master/Slave) (ch) | UART (ch) | DMA (ch) | True Random Number Generator | Compressor & Decompressor | SPI (ch) | PWM (ch) | 32-bit Timer | Watchdog Timer | 12-bit ADC | 24-bit ADC | DAC | USB            | LED driver | Operating Temperature (°C) |
|-------------|--------------------------------------------|----------------|---------------------|-----------|------------|--------------|-------------------------|------------------|------------------|-----------|-------------------------------|-----------|-------------------------|-----------|----------|------------------------------|---------------------------|----------|----------|--------------|----------------|------------|------------|-----|----------------|------------|----------------------------|
| TZ1201XBG   | PUFBGA210<br>(8.0 mm x 8.0 mm)<br>(0.4 mm) | ARM Cortex-M4F | 96 (up to 120)      | 2.2       | 2          | 1            | ●                       | ●                | ●                | ●         | ●                             | 120       | 2                       | 4         | 16       | 1                            | 1                         | 4        | 8        | 2            | 1              | 16         | 4          | 1   | USB 2.0 Device | 4          | Ta = -20 to 70             |

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TZ2000 Series / TZ2000 シリーズ

| Part Number | Package<br>(package size)<br>(ball bitch)      | CPU                    | CPU Frequency | SRAM (MByte)             | L1 I Cache (Kbyte) | L1 D Cache (Kbyte) | L2 Cache (Kbyte) | DRAM Controller     | External Extended Bus Interface | 2D Graphic Engine                        | LCD Controller                                        | USB                 | UART | I <sup>2</sup> C | I <sup>2</sup> S | SPIB | SPIM | PWM | 12bit ADC | SDIO/e-MMC | GPIO | DMA controller | Timer/Counter | RTC | Secure Boot System<br>&<br>Encrypt Data Function | FPU | Camera I/F | Operating Temperature (°C)                      |                                                 |
|-------------|------------------------------------------------|------------------------|---------------|--------------------------|--------------------|--------------------|------------------|---------------------|---------------------------------|------------------------------------------|-------------------------------------------------------|---------------------|------|------------------|------------------|------|------|-----|-----------|------------|------|----------------|---------------|-----|--------------------------------------------------|-----|------------|-------------------------------------------------|-------------------------------------------------|
| TZ2002XBG   | PLFBGA280<br>(15 mm x 15 mm)<br>(0.8 mm pitch) | ARM® Cortex®-A9 MPCore | 200           | 1                        | 16                 | 16                 | —                | DDR3/DDR3L x 8 bit  | —                               | Toshiba original graphics<br>accelerator | WVGA (800 x 480 pixel) 60 fps,<br>24 bit Parallel I/F | USB2.0 host/device  | 4    | 5                | 2                | 2    | 2    | 5   | 4         | 2          | 64   | ●              | 9             | 1   | —                                                | —   | —          | Ta = -20 to 70<br>Ta = -40 to 85 <sup>(1)</sup> |                                                 |
| TZ2003XBG   | PLFBGA280<br>(15 mm x 15 mm)<br>(0.8 mm pitch) |                        |               |                          |                    |                    |                  |                     |                                 |                                          |                                                       |                     |      |                  |                  |      |      |     |           |            |      |                |               |     |                                                  |     |            |                                                 | ●                                               |
| TZ2100XBG   | PLFBGA310<br>(16 mm x 16 mm)<br>(0.8 mm pitch) |                        | 300           | 1<br>MB<br>+<br>32<br>KB | 32                 | 32                 | 128              | DDR3/DDR3L x 16 bit | Address: 27 bit, Data: 32 bit   | Toshiba original graphics<br>accelerator | WVGA (800 x 480 pixel) 60 fps,<br>24 bit Parallel I/F | USB2.0 host /device | 4    | 4                | 2                | 2    | 7    | 6   | 4         | 3          | 128  | ●              | 9             | 1   | —                                                | ●   | ●          |                                                 | Ta = -20 to 80<br>Ta = -40 to 85 <sup>(1)</sup> |
| TZ2101XBG   |                                                |                        |               |                          |                    |                    |                  |                     |                                 |                                          |                                                       |                     |      |                  |                  |      |      |     |           |            |      |                |               |     |                                                  |     |            |                                                 |                                                 |
| TZ2102XBG   |                                                |                        | —             | 600                      | —                  | —                  | —                | —                   | —                               | —                                        | —                                                     | —                   | —    | —                | —                | —    | —    | —   | —         | —          | —    | —              | —             | —   | —                                                | —   | —          |                                                 | —                                               |

Note(1): Extended temperature range / 温度拡張品

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TZA300 Series / TZA300 シリーズ

| Part Number | Package<br>(package size)                      | Video I/O Interface                                                                                           | Video Input<br>Port | Video Output<br>Port | Feature                                                                                                                                                                                                             | Applications                                                    | Supply Voltage (V)                                  |
|-------------|------------------------------------------------|---------------------------------------------------------------------------------------------------------------|---------------------|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------|
| TZA300XBG   | PFBGA448<br>(19 mm x 19 mm)<br>(0.8 mm pitch ) | • LVC MOS Parallel I/O<br>- YUV/RGB 444<br>(24 bit)<br>- YUV 422 (16 bit)<br>- YUV 422 (8 bit) <sup>(1)</sup> | 1                   | 2                    | • Up to 1080p @ 60 fps <sup>(2)</sup><br>• Video Dynamic Range Enhancing<br>• Ultra-low latency processing<br>(100 pixel clock cycles or less)<br>• 3D Noise Reduction<br>• Control Interface: I <sup>2</sup> C BUS | Surveillance<br>camera system<br>Surveillance<br>monitor system | Core, PLL: 1.2<br>DDR3 I/F: 1.5/2.5<br>I/O: 1.8/3.3 |

Note(1): YC multiplex for only 480p/576p

(2): Special license file is required for performing dynamic range enhancer processing of input videos other than VGA, 480p and 576p. For more information kindly contact the sales division. / VGA、480P及び576P以外の入力映像に対する鮮明化には特別なライセンスファイルが必要です。 詳細については、営業部門にお問い合わせください。

## Interface Bridges / インタフェースブリッジ

### MPD: Mobile Peripheral Devices

| Part Number    | Package<br>(Package Size)<br>(Ball Pitch)   | Functions                                                     |                                                                                     | Feature/Supported Resolution                                                                                                                                                                                         | Applications                                                                                                                                                                                                  | Supply Voltage (V)                                                |
|----------------|---------------------------------------------|---------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
|                |                                             | Rx (input)                                                    | Tx (output)                                                                         |                                                                                                                                                                                                                      |                                                                                                                                                                                                               |                                                                   |
| TC358743XBG ☆  | P-TFBGA64<br>(6 mm x 6 mm)<br>(0.65 mm)     | HDMI® 1.4                                                     | MIPI® CSI-2 1.01                                                                    | HDMI® to MIPI® CSI-2 Camera<br>Serial Interface Bridge<br>HDMI® Video format: Up to FHD<br>(1920 x 1080, 60 fps, 24 bpp (bits<br>per pixel))                                                                         | Smart TV,<br>smart monitor,<br>smart set-top box,<br>Digital Media Adapter<br>(DMA)                                                                                                                           | 1.2 (MIPI®/Core)<br>3.3 (HDMI®)<br>1.8 to 3.3 (I/O)<br>2.5 (APLL) |
| TC358749XBG ☆  | P-VFBGA80<br>(7 mm x 7 mm)<br>(0.65 mm)     | HDMI® 1.4b                                                    | MIPI® CSI-2 1.01                                                                    | HDMI® to MIPI® CSI-2 Camera<br>Serial Interface Bridge<br>Video de-interlacing, Video scaling<br>HDMI® Video format: Up to FHD<br>(1920 x 1080, 60 fps, 24 bpp)                                                      | Smart TV,<br>smart monitor,<br>smart set-top box, DMA                                                                                                                                                         | 1.2 (MIPI®/Core/PLL)<br>3.3 (HDMI®)<br>1.8 to 3.3 (I/O)           |
| TC358840XBG ☆  | P-VFBGA80<br>(7 mm x 7 mm)<br>(0.65 mm)     | HDMI® 1.4b                                                    | MIPI® CSI-2 1.01                                                                    | HDMI® to MIPI® CSI-2 Camera<br>Serial Interface Bridge<br>HDMI® Video format: Up to 4K Ultra<br>HD (3840 x 2160, 30 fps, 24 bpp)                                                                                     | Smart set top box,<br>smart TV,<br>smart monitor, DMA                                                                                                                                                         | 1.2 MIPI®<br>1.1 CORE/PLL<br>3.3 (HDMI®)<br>1.8 to 3.3 (I/O)      |
| TC358779XBG ☆  | P-VFBGA80<br>(7 mm x 7 mm)<br>(0.65 mm)     | HDMI® 1.4b                                                    | MIPI® DSI 1.1                                                                       | HDMI® to MIPI® DSI Display Serial<br>Interface Bridge<br>Video de-interlacing, Video scaling<br>HDMI® Video format: Up to FHD<br>(1920 x 1080, 60 fps, 24 bpp)                                                       | Tablet,<br>digital still camera<br>(DSC), LCD displays,<br>video projector,<br>head mounted display<br>(HMD),<br>game accessory,<br>other integrated display<br>panel application with<br>MIPI® DSI interface | 1.2 (MIPI®/CORE/PLL)<br>3.3 (HDMI®)<br>1.8 to 3.3 (I/O)           |
| TC358870XBG ☆  | P-VFBGA80<br>(7mm x 7mm)<br>(0.65 mm)       | HDMI® 1.4b                                                    | MIPI® DSI 1.1                                                                       | HDMI® to MIPI® DSI Display Serial<br>Interface Bridge<br>HDMI® Video format: Up to 4K Ultra<br>HD (3840 x 2160, 30 fps, 24 bpp)                                                                                      | HMD, mobile devices,<br>gaming accessories,<br>wearable computers<br>display                                                                                                                                  | 1.2 MIPI®<br>1.1 CORE/PLL<br>3.3 (HDMI®)<br>1.8 to 3.3 (I/O)      |
| TC358746AXBG ☆ | P-VFBGA72<br>(4.5 mm x 4.5 mm)<br>(0.40 mm) | (1) MIPI® CSI-2 1.01<br>(2) Parallel                          | (1) Parallel<br>(2) MIPI® CSI-2 1.01                                                | MIPI® CSI-2 to Parallel Camera<br>Interface Bridge<br>Parallel to MIPI® CSI-2 Camera<br>Interface Bridge<br>Up to 100 MHz PCLK frequency<br>for Output mode, and 166 MHz for<br>Input mode.                          | Smartphone, tablet,<br>VOIP phone,<br>industrial device                                                                                                                                                       | 1.2 (MIPI®/Core)<br>1.8 to 3.3 (I/O)                              |
| TC358748XBG ☆  | P-VFBGA80<br>(7 mm x 7 mm)<br>(0.65 mm)     |                                                               |                                                                                     |                                                                                                                                                                                                                      |                                                                                                                                                                                                               |                                                                   |
| TC358762XBG ☆  | P-VFBGA64<br>(5 mm x 5 mm)<br>(0.50 mm)     | (1) MIPI® DSI 1.01<br>(2) MIPI® DSI 1.01                      | (1) MIPI® DPI 2.0<br>(2) MIPI® DBI-2 2.0                                            | MIPI® DSI to MIPI® DPI/DBI Display<br>Interface Bridge<br>Up to WXGA (1366 x 768, 60 fps,<br>24 bpp)                                                                                                                 | Tablet, smartphone,<br>smart watch, HMD,<br>portable navigation<br>device (PND)                                                                                                                               | 1.2 (MIPI®/Core)<br>1.8 to 3.3 (I/O)                              |
| TC358763XBG ☆  | P-VFBGA72<br>(4.5 mm x 4.5 mm)<br>(0.40 mm) | (1) MIPI® DPI 2.0<br>(2) MIPI® DBI-2 2.0                      | (1) MIPI® DSI 1.01<br>(2) MIPI® DSI 1.01                                            | MIPI® DPI/DBI to MIPI® DSI Display<br>Interface Bridge<br>Up to XGA (1024 x 768, 60 fps, 24<br>bpp)                                                                                                                  | Smartphone, DSC,<br>digital video camera<br>(DVC), smart watch,<br>HMD, PND                                                                                                                                   | 1.2 (MIPI®/Core)<br>1.8 to 3.3 (I/O)                              |
| TC358764XBG ☆  | P-TFBGA49<br>(5 mm x 5 mm)<br>(0.65 mm)     | MIPI® DSI 1.01                                                | LVDS                                                                                | MIPI® DSI to LVDS Display Interface<br>Bridge (single link)<br>Up to WXGA (1366 x 768, 24 bpp)                                                                                                                       | Tablet,<br>Ultrabook™                                                                                                                                                                                         | 1.2 (MIPI®/Core)<br>3.3 (LVDS)<br>1.8 to 3.3 (I/O)                |
| TC358765XBG ☆  | P-TFBGA64<br>(6 mm x 6 mm)<br>(0.65 mm)     | MIPI® DSI 1.01                                                | LVDS                                                                                | MIPI® DSI to LVDS Display Interface<br>Bridge (dual link)<br>Up to UXGA (1600 x 1200, 24 bpp)                                                                                                                        | Tablet,<br>Ultrabook™                                                                                                                                                                                         | 1.2 (MIPI®/Core)<br>3.3 (LVDS)<br>1.8 to 3.3 (I/O)                |
| TC358766XBG ☆  | P-VFBGA120<br>(6 mm x 6 mm)<br>(0.50 mm)    | (1) MIPI® DSI 1.01<br>(2) MIPI® DPI 2.0<br>(3) MIPI® DSI 1.01 | (1) VESA DisplayPort™<br>1.1a<br>(2) VESA DisplayPort™<br>1.1a<br>(3) MIPI® DPI 2.0 | MIPI® DSI to DisplayPort® Display<br>Interface Bridge<br>MIPI® DPI to DisplayPort® Display<br>Interface Bridge<br>MIPI® DSI to MIPI® DPI Display<br>Interface Bridge<br>Up to WUXGA (1920 x 1200, 60 fps,<br>24 bpp) | Tablet,<br>Ultrabook™                                                                                                                                                                                         | 1.2 (MIPI®/Core)<br>1.2 & 1.8 (DisplayPort®)<br>1.8 (I/O)         |
| TC358767AXBG ☆ | P-VFBGA81<br>(5 mm x 5 mm)<br>(0.50 mm)     | (1) MIPI® DSI 1.01<br>(2) MIPI® DPI 2.0                       | (1) VESA DisplayPort™<br>1.1a<br>(2) VESA DisplayPort™<br>1.1a                      | MIPI® DSI to DisplayPort® Display<br>Interface Bridge<br>MIPI® DPI to DisplayPort® Display<br>Interface Bridge<br>Up to WUXGA (1920 x 1200, 60 fps,<br>24 bpp)                                                       | Tablet,<br>Ultrabook™                                                                                                                                                                                         | 1.2 (MIPI®/Core)<br>1.2 & 1.8 (DisplayPort®)<br>1.8 (I/O)         |
| TC358768AXBG ☆ | P-VFBGA72<br>(4.5 mm x 4.5 mm)<br>(0.40 mm) | RGB                                                           | MIPI® DSI 1.02                                                                      | RGB to MIPI® DSI Display Interface<br>Bridge<br>Up to WUXGA (1920 x 1200, 60 fps,<br>24-bit/pixel)                                                                                                                   | Smartphone, tablet,<br>Ultrabook™                                                                                                                                                                             | 1.2 (MIPI®/Core)<br>1.8 to 3.3 (I/O)                              |
| TC358778XBG ☆  | P-VFBGA80<br>(7 mm x 7 mm)<br>(0.65 mm)     |                                                               |                                                                                     |                                                                                                                                                                                                                      |                                                                                                                                                                                                               |                                                                   |
| TC358770AXBG ☆ | P-VFBGA100<br>(5 mm x 5 mm)<br>(0.40 mm)    | MIPI® DSI 1.02                                                | VESA DisplayPort™<br>1.1a                                                           | MIPI® DSI to DisplayPort® Display<br>Interface Bridge<br>Up to (QSXGA 2560 x 2048, 60 fps,<br>24 bit per pixel)                                                                                                      | Tablet,<br>Ultrabook™                                                                                                                                                                                         | 1.2 (MIPI®/Core)<br>1.2 & 1.8 (DisplayPort®)<br>1.8 (I/O)         |
| TC358777XBG ☆  | P-VFBGA80<br>(7 mm x 7 mm)<br>(0.65 mm)     |                                                               |                                                                                     |                                                                                                                                                                                                                      |                                                                                                                                                                                                               |                                                                   |

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## MPD: Mobile Peripheral Devices

| Part Number   | Package<br>(Package Size)<br>(Ball Pitch) | Functions                               |                | Feature/Supported Resolution                                                                                                                           | Applications                               | Supply Voltage (V)                                                                         |
|---------------|-------------------------------------------|-----------------------------------------|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|--------------------------------------------------------------------------------------------|
|               |                                           | Rx (input)                              | Tx (output)    |                                                                                                                                                        |                                            |                                                                                            |
| TC358771XBG ☆ | P-VFBGA49<br>(5 mm x 5 mm)<br>(0.65 mm)   | MIPI® DSI 1.01                          | LVDS           | MIPI® DSI to LVDS Display Interface Bridge with Back Light Control (single link)<br>Up to UXGA (1600 x 1200, 60 fps, 24 bpp)                           | Tablet, Ultrabook™                         | 1.2 (MIPI®/Core)<br>1.8 (LVDS)<br>1.8 to 3.3 (I/O)                                         |
| TC358772XBG ☆ | P-VFBGA 64<br>(6 mm x 6 mm)<br>(0.65 mm)  | MIPI® DSI 1.01                          | LVDS           | MIPI® DSI to LVDS Display Interface Bridge with Back Light Control (dual link)<br>Up to WUXGA (1920 x 1200, 60 fps, 24 bpp)                            | Tablet, Ultrabook™                         | 1.2 (MIPI®/Core)<br>1.8 (LVDS)<br>1.8 to 3.3 (I/O)                                         |
| TC358774XBG ☆ | P-VFBGA49<br>(5 mm x 5 mm)<br>(0.65 mm)   | MIPI® DSI 1.01                          | LVDS           | MIPI® DSI to LVDS Display Interface Bridge (single link)<br>Up to UXGA (1600 x 1200, 60 fps, 24 bpp)                                                   | Tablet, Ultrabook™                         | 1.2 (MIPI®/Core)<br>1.8 (LVDS)<br>1.8 to 3.3 (I/O)                                         |
| TC358775XBG ☆ | P-VFBGA64<br>(6 mm x 6 mm)<br>(0.65 mm)   | MIPI® DSI 1.01                          | LVDS           | MIPI® DSI to LVDS Display Interface Bridge (dual link)<br>Up to WUXGA (1920 x 1200, 60 fps, 24 bpp)                                                    | Tablet, Ultrabook™                         | 1.2 (MIPI®/Core)<br>1.8 (LVDS)<br>1.8 to 3.3 (I/O)                                         |
| TC358860XBG ☆ | P-VFBGA65<br>(5 mm x 5 mm)<br>(0.5 mm)    | VESA Embedded DisplayPort (eDP™) ver1.4 | MIPI® DSI 1.02 | 4K2K VESA's Embedded Display Port (eDP™) to MIPI® DSI Display Serial Interface Bridge<br>Up to 4K Ultra HD (4096 x 2048, 60 fps, 3840 x 2160@, 24 bpp) | Phablet, tablet, portable game and PC, HMD | 1.2 (MIPI®)<br>1.1 (Core, MIPI® D-PHY, eDP-PHY)<br>1.8 (eDP™-PHY)<br>1.8 or 3.3 (I/O, HPD) |

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## I/O Expander

| Part Number  | Package<br>(Pin Pitch) | Functions    | Applications       | Functions and Features                                                                                                                                                                                                                                                    | Supply Voltage (V) |
|--------------|------------------------|--------------|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| TC35894XBG ☆ | P-TFBGA36<br>(0.5 mm)  | I/O expander | I/O port expansion | Up to 24 GPIO ports. GPIO ports can be used for key matrix (up to 96 keys) or PWM/timer (up to 3 channels).<br>Chattering reduction, internal clock oscillator, internal pull-up/pull-down resistors<br>Up to 26-port direct key functionality (when GPIOs are not used). | 1.62 to 3.60       |
| TC35894FG ☆  | P-LQFP44<br>(0.8 mm)   |              |                    | Up to 24 GPIO ports. GPIO ports can be used for key matrix (up to 96 keys) or PWM/timer (up to 3 channels).<br>Chattering reduction, internal clock oscillator, internal pull-up/pull-down resistors<br>Up to 26-port direct key functionality (when GPIOs are not used)  | 1.62 to 3.60       |

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## Other Product ICs / その他機器用

### Shock Sensor ICs / ショックセンサIC

| Part Number | Package | Device Type                                | Output Source Current Min (μA)           | Output Sink Current Min (μA) | Window-Comparator Detection Voltage Levels Typ. (V) | Supply Current (Ta = 25°C ) Max (mA)                     | Supply Voltage (V) | Remarks                                                           |
|-------------|---------|--------------------------------------------|------------------------------------------|------------------------------|-----------------------------------------------------|----------------------------------------------------------|--------------------|-------------------------------------------------------------------|
| TB6082FNG   | VSOP10  | Shock sensor amp (low-noise charge amp)    | 80 (OP-AMP2) (@ V <sub>CC</sub> - 0.3 V) | 500 (OP-AMP2) (@ 0.3 V)      | —                                                   | 5.0 (V <sub>CC</sub> = 2.5 V, V <sub>ref</sub> = 1.0 V)  | 2.3 to 5.5         | 1 channel, Built-in amplifier for notch filter, low-noise         |
| TB6082FTG   | QFN16   | Shock sensor amp (low-noise charge amp)    | 80 (OP-AMP2) (@ V <sub>CC</sub> - 0.3 V) | 500 (OP-AMP2) (@ 0.3 V)      | —                                                   | 5.0 (V <sub>CC</sub> = 2.5 V, V <sub>ref</sub> = 1.0 V)  | 2.3 to 5.5         | 1 channel, Built-in amplifier for notch filter, low-noise         |
| TB6086FTG   | QFN16   | Shock sensor amp (Sensor signal Amplifier) | 100 (OP-AMP) (@ V <sub>CC</sub> - 0.3 V) | 100 (OP-AMP) (@ 0.3 V)       | 2.05 (High)<br>1.25 (Low)                           | 4.0 (V <sub>CC</sub> = 3.3 V, V <sub>ref</sub> = 1.65 V) | 3.0 to 5.5         | 1 channel, Built-in amplifier for notch filter, Window Comparator |
| TC93A33FTG  | QFN16   | Shock sensor amp (low-noise charge amp)    | 80 (OP-AMP2) (@ V <sub>CC</sub> - 0.3 V) | 80 (OP-AMP2) (@ 0.3 V)       | —                                                   | 4.5 (V <sub>CC</sub> = 1.8 V, EN = H)                    | 1.6 to 2.3         | 1 channel, Built-in amplifier for notch filter, low-noise         |

### High-Frequency Modulator ICs / 高周波重畳IC

| Part Number | Package | Device Type                                      | Frequency (MHz) | Amplitude (mApp) | Operating Current Consumption (V <sub>DD</sub> = 5.0 V, Ta = 25°C ) Max (mA) | Supply Voltage (V) | Remarks              |
|-------------|---------|--------------------------------------------------|-----------------|------------------|------------------------------------------------------------------------------|--------------------|----------------------|
| TC93A14AFUG | SSOP6   | High-frequency modulator for optical disk (2-ch) | 250 to 450      | 25 to 80         | 21.5                                                                         | 4.5 to 5.5         | Spread spectrum type |

### Interface ICs for Hot Water Dispensers / 給湯器用インタフェースIC

| Part Number | Package | Features                                                                                                            | Applications                           | Supply Voltage (V) |
|-------------|---------|---------------------------------------------------------------------------------------------------------------------|----------------------------------------|--------------------|
| T6B70BFG    | SOP16   | Carrier receiver, carrier identification, carrier pseudo-sine wave generator                                        | Communication for hot water dispensers | 4.5 to 5.5         |
| T6B70BFNG   | SSOP16  | Carrier receiver, carrier identification, carrier pseudo-sine wave generator<br>Smaller package version of T6B70BFG | Communication for hot water dispensers | 4.5 to 5.5         |



# SEMICONDUCTOR GENERAL CATALOG

## 半導体製品総覧表

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